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(54) Abstract Title
Cyclone type vacuum cleaner with rotatable filter

(57) A cyclone type vacuum cleaner has a filter 50 rotatably mounted on an outer casing 11 of a dirt collector 30, between an open/suction space 11a and a closed space 11b of the body 10 of the cleaner, which includes vanes, external 55 or internal (55, fig.5), to allow the filter 50 to rotate under the power of air currents generated by a vacuum motor 20 mounted in closed space 11b. The suction space is contained within a dirt collecting container 30, detachably mounted to the cleaner body 10. The filter may be mounted via a rotational support member which may be an annular bearing (73, fig.4A). The filter may have a closed bottom (50, fig.4A) and a plurality of air holes 51 formed along the outer circumference, and at least fours vanes to allow filter rotation.

FIG.2

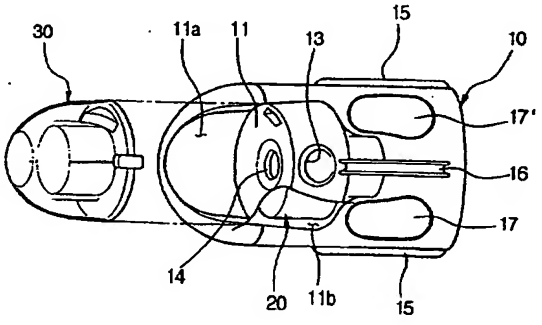

FIG.3

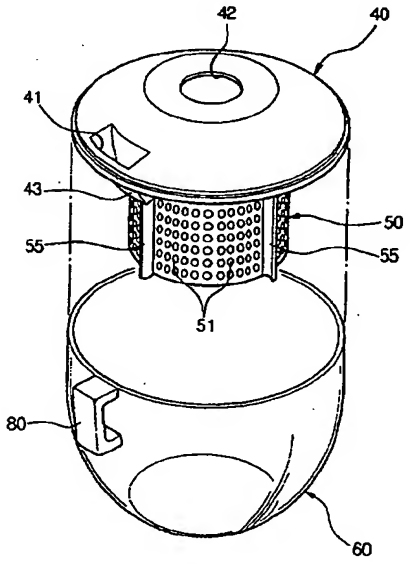

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FIG. 1

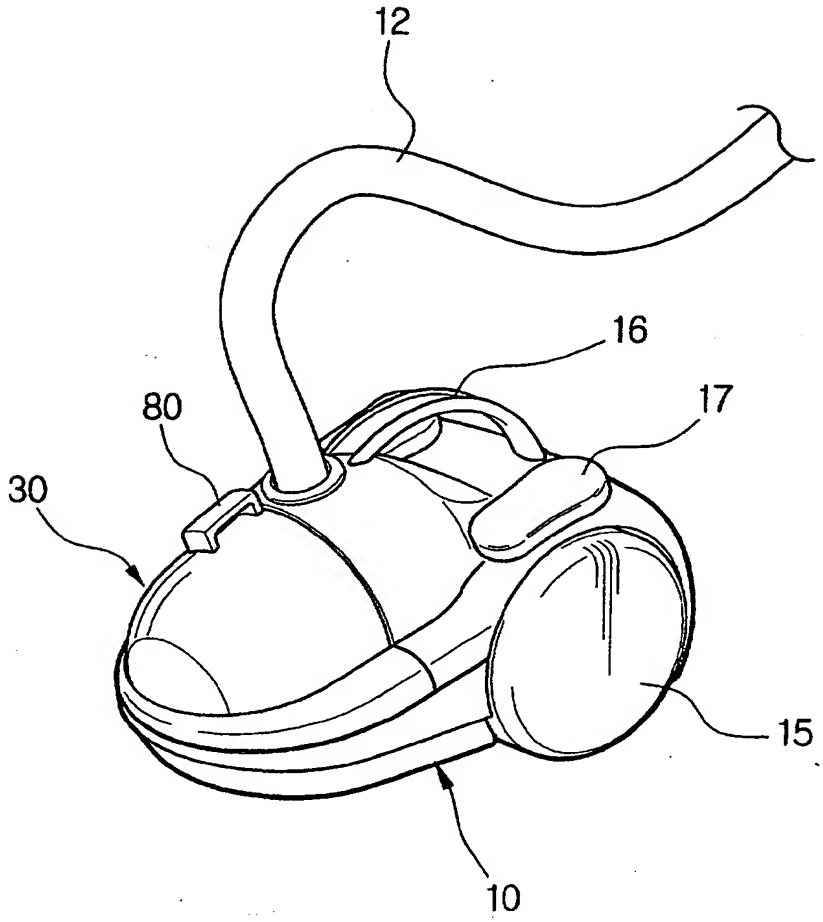


FIG.2

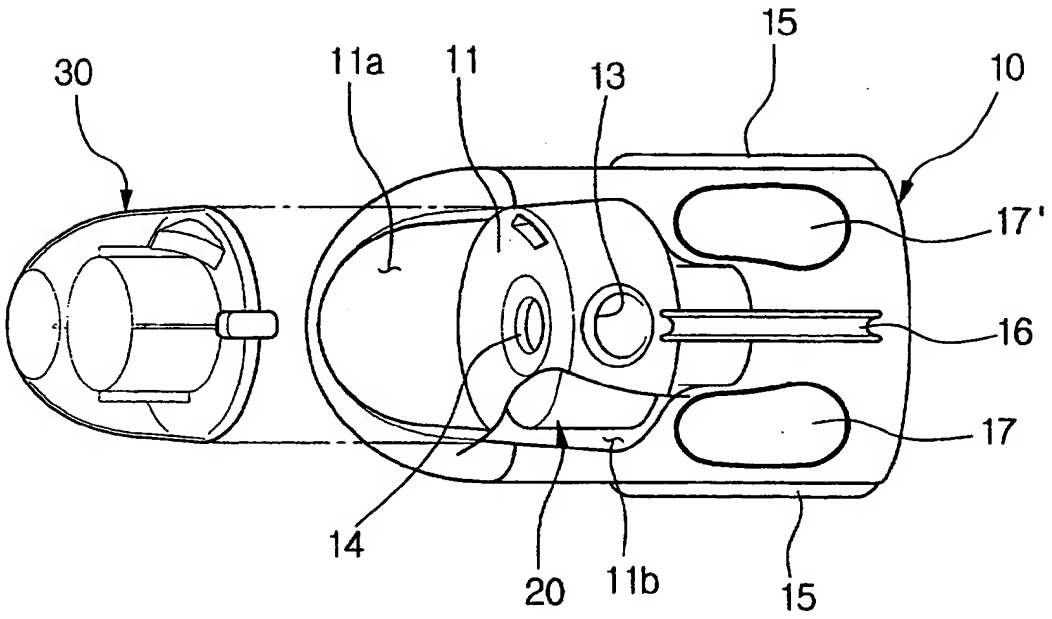


FIG.3

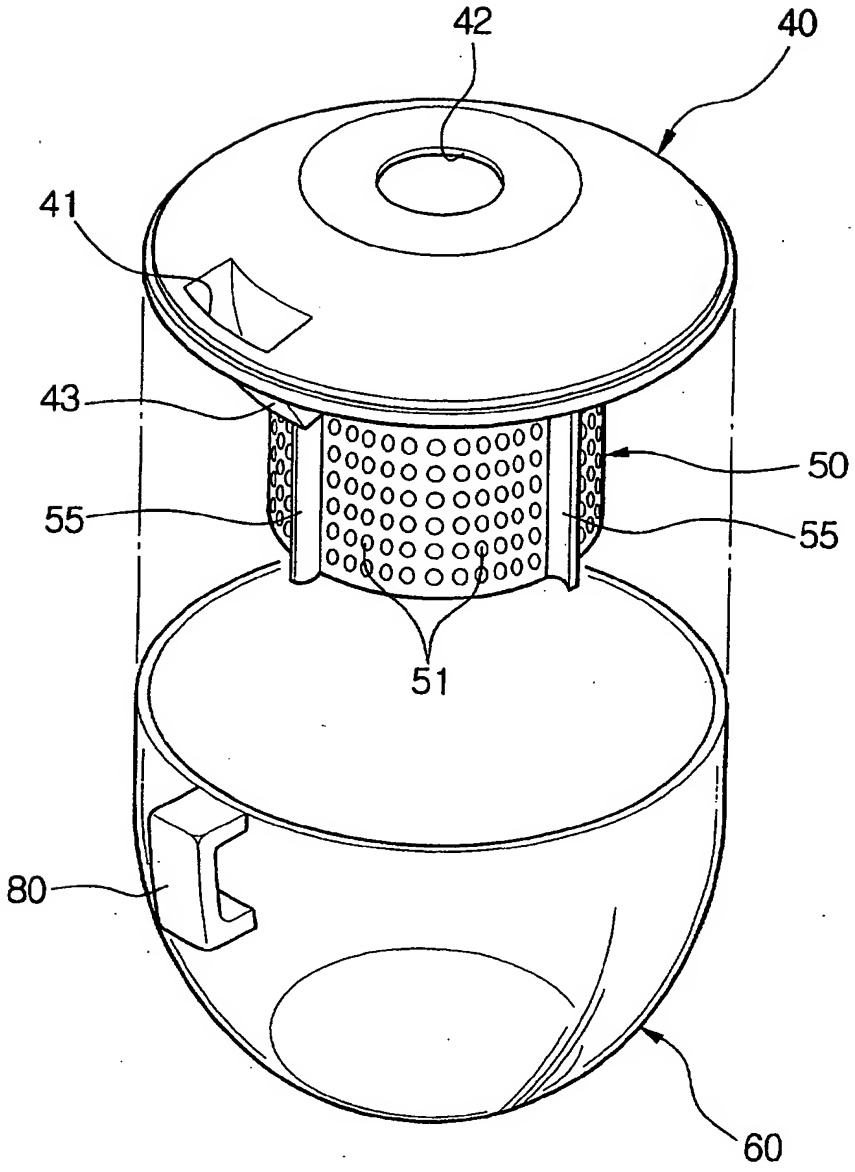


FIG.4A

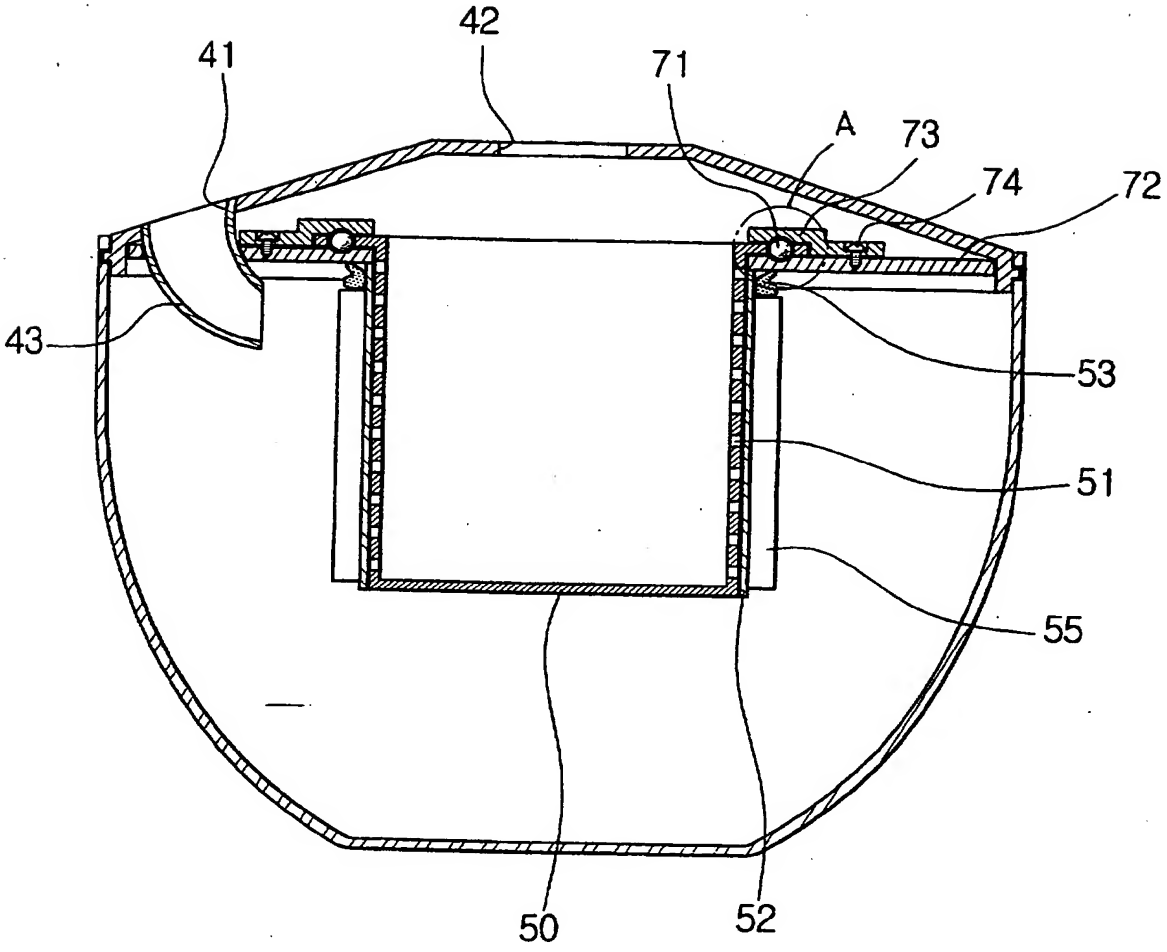


FIG.4B

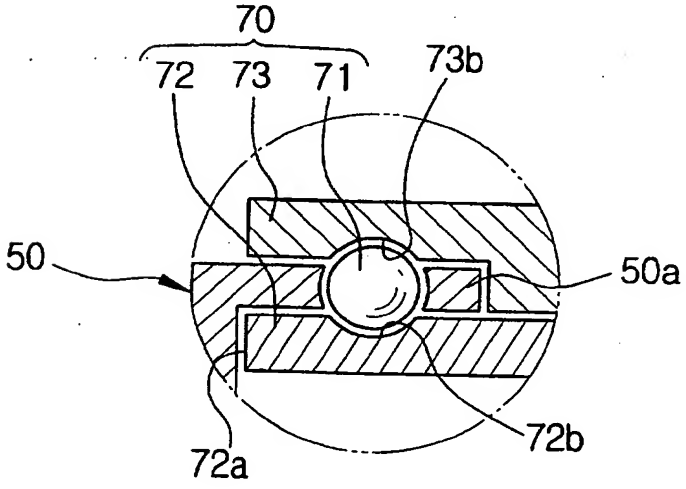
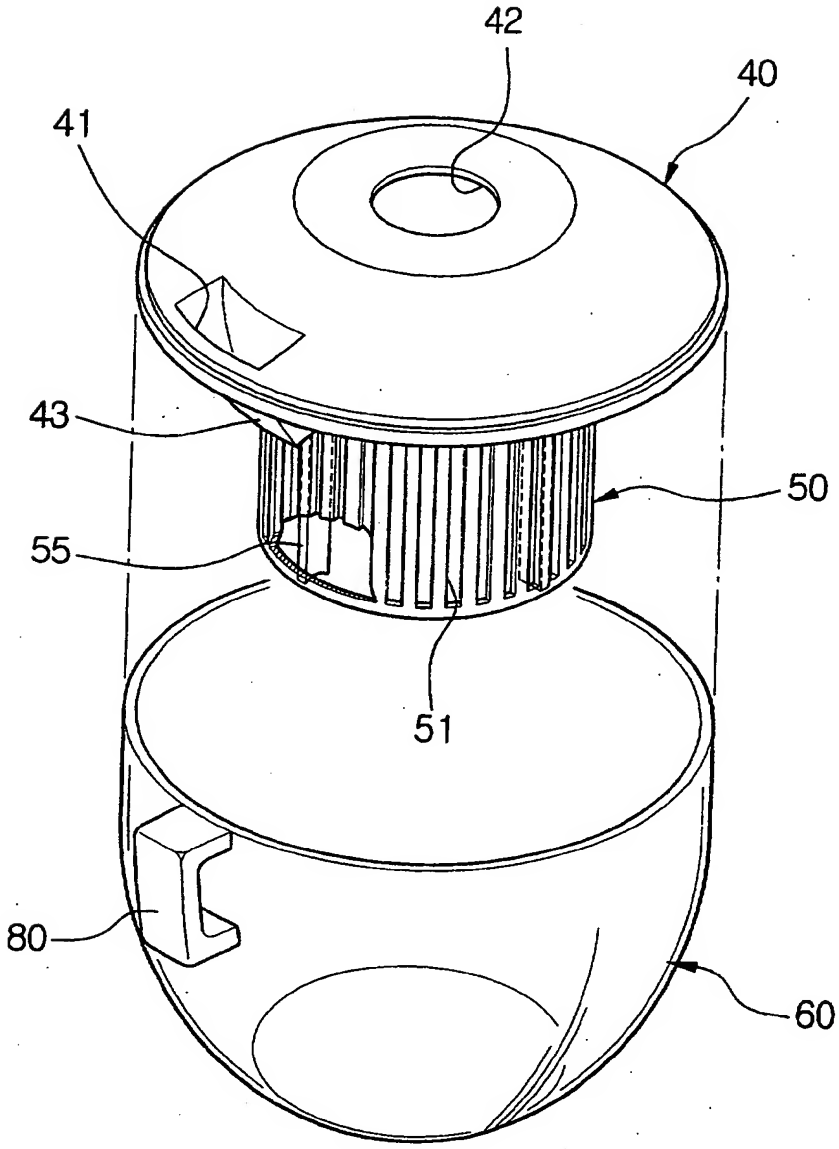


FIG.5



VACUUM CLEANER

The present invention relates to a vacuum cleaner, and more particularly, to a vacuum cleaner having a cyclone type dirt collecting section for semi-permanent use.

Generally, a vacuum cleaner has a separable dust bag mounted in a dust chamber of a body. The dust bag collects dirt and dust in air which is sucked up through a suction port of the vacuum cleaner. As the amount of collected dirt and dust increases, various problems such as the deterioration of suction, overload on the motor, etc., occur. Accordingly, the dust bag must be replaced regularly. The present applicant has disclosed a vacuum cleaner having a cyclone type dirt collecting means, which can be semi-permanently used to improve both the filtering effect and inconvenience caused due to frequent replacement of the dust bag, in the Korean Patent Application No. 10-1999-55954, filed 8 December 1999.

According to the above-mentioned Korean Patent Application No. 99-55954, in a vacuum cleaner having a dirt collecting chamber which has a suction port, and a load driving chamber which has a suctioning section for sucking up air with dirt through the suction port into the dirt collecting chamber, the vacuum cleaner further includes a dirt collecting container mounted in the dirt collecting chamber having an outer opening and an air inlet which is interconnected with the suction port, a guiding duct for guiding the air discharged through the opening of the dirt collecting container into the load driving chamber, a filter rotatably disposed in the opening area of the dirt collecting container, and a rotating section for rotating the filter. Further, according to the above application, the filter rotating section includes a bearing disposed between the outer surface of the filter and the support section of the filter for rotatably supporting the filter, a rotating fan disposed above the filter, and a rotary shaft for coaxially connecting the rotating fan with the filter.

In the disclosed vacuum cleaner, air containing dust and dirt is sucked in through the suction port into the dirt collecting container in an oblique direction, which forms a circulating air current in the dirt collecting container. Accordingly, larger dirt or dust

particles are separated by centrifugal force and filtered out through the filter by the upwardly turning circular air current. In such a situation, since the rotating fan and the filter are rotated by the air current, a more effective circulating air current is formed in the dirt collecting container, so that dust and dirt do not cling to the filter.

The vacuum cleaner described as above, however, requires the rotation fan, rotary shaft, and fan accommodating section, etc. for rotating the filter, and has shortcomings such as a complex structure and manufacturing process as well as higher manufacturing cost, etc.

In the light of the above-mentioned problems it is an object of the present invention to provide a vacuum cleaner having a cyclone type dirt collecting section with a simple structure, easier manufacturing process, and low manufacturing cost.

According to the present invention, a vacuum cleaner comprises: a body having open and closed spaces divided by a partition, a suction brush connecting port which is formed on an upper part of the body, which port communicates with the open space, and an interconnecting hole formed on the partition for interconnecting the open and closed spaces; a motor mounted in the closed space of the body for generating a suction force; and a dirt collecting section detachably mounted in the open space of the body for centrifugally separating dirt and dust contained in the air sucked in through the suction brush connecting port by the motor when it is operated.

In a preferred embodiment of the invention, the dirt collecting section includes: an outer casing having an air inlet and outlet which are respectively associated with the suction brush connecting port and the interconnecting hole; a cylindrical filter rotatably mounted on the outer casing by a rotational supporting member and having one closed end and a plurality of air holes which are formed in the outer circumference; at least four vanes or wings formed on the filter for rotating the filter with air current which flows in through the air inlet; and a dirt collecting container detachably formed on the outer casing to enclose the filter.

The rotation supporting section may comprise a plurality of steel balls press-fitted to a flange portion which extends outwardly and generally perpendicularly to the filter rotation axis from the open end of the filter; a supporting plate connected to the outer casing and having a filter positioning hole formed in its middle portion and a first guiding groove formed adjacent to the filter positioning hole for movably supporting the steel balls; and a guiding ring fixed on the supporting plate and having a second guiding groove corresponding to the first guiding groove for movably supporting the steel balls.

Further, the vanes may extend in a longitudinal direction, being formed on the outer circumference of the filter at equal intervals, or they may be formed on the inner circumference of the filter at equal intervals. When the vanes are formed on the outer circumference of the filter, it is preferable that the air holes of the filter are formed to have circular or elliptical shapes. When they are formed on the inner circumference of the filter, it is preferable that the air holes of the filter are shaped as slots in the filter extending in the longitudinal direction.

The invention will now be described by way of example with reference to the drawings in which:

Figure 1 is a perspective view of a preferred vacuum cleaner in accordance with the invention;

Figure 2 is a partially cut away perspective view of the cleaner of Figure 1 showing a dirt collecting section thereof disassembled from the body of the vacuum cleaner;

Figure 3 is an exploded perspective view of the dirt collecting section;

Figure 4A is a sectional view showing the dirt collecting section in an assembled state;

Figure 4B is an enlargement of the encircled area A of Figure 4A; and

Figure 5 is an exploded perspective view of the dirt collecting section of an alternative vacuum cleaner in accordance with the present invention.

Referring to Figures 1 and 2, a preferred vacuum cleaner in accordance with the present invention includes a body 10, a motor 20, and a removable dirt collecting section 30.

The body 10 of the vacuum cleaner is divided by a partition 11 into an open space 11a on one side of the partition, and a closed space 11b on the other side. Here, the partition 11 is circular and includes a depression inwardly sunken towards the closed space 11b. Furthermore, the open space 11a is bounded by a positioning section substantially semi-circular in shape. The body 10 includes a connecting port 13 in its upper wall which communicates with the open space 11a and receives a suction brush hose 12. The partition 11 includes a central hole 14 interconnecting the open and closed spaces 11a and 11b. A pair of wheels 15 is mounted on opposite sides of the body 10 for an easy movement of the body 10. Although not shown, the body 10 also includes rollers on its lower surface for an easy movement of the body 10. The body 10 further includes a handle 16 which is centrally formed on its upper portion and a pair of operating buttons 17 and 17' formed on opposite sides of the handle 16. In this case, one button 17 is a power-on button, and the other button 17' is a cord reeling button. The body 10 also includes an exhaust hole (not shown) formed on a rear end of the closed space 11b, with a grille arranged over the hole.

The motor 20 is so mounted in the closed space 11b of the body 10 to generating a suction force which causes outside air to be sucked in through the suction brush hose 12 and discharged outwardly through the discharging hole formed at the rear end of the closed space 11b via the dirt collecting section 30 which will be described later. During this process, dust and dirt in the air are separated from the air by the dirt collecting section 30, and the cleaned air is discharged to the outside.

The dirt collecting section 30 separates and retains dust and dirt in the incoming air by centrifugal force. The dirt collecting section 30 includes an outer casing 40, a filter 50, and a dirt collecting container 60 as shown in Figures 3, 4A, and 4B. The outer casing 40 includes an air inlet 41 which communicates with the suction brush connecting port 13 of the body 10 when the dirt collecting section 30 is assembled to the body 10, and an air outlet 42 which communicates with the interconnecting hole 14 of the body 10.

The outer casing 40 is in the shape of a cone to correspond with the depression of the partition 11 of the body 10. Furthermore, the air inlet 41 is connected to the guiding port 43 inclined so as to guide air from the port 13 obliquely towards the dirt collecting container 60. Accordingly, the air sucked in between the filter 50 and the dirt collecting container 60 forms a circular air current circulating around a central longitudinal axis of the dirt collecting section 30.

The filter 50 is a rotatable member which is mounted below and adjacent an air outlet 42 of the outer casing 40 by a rotation supporting section 70. The filter 50 is a cylindrical structure which has one closed end, and a plurality of air holes 51 formed along the outer circumference for efficiently discharging air while blocking larger particles of dirt and dust. Preferably, a non-woven fabric 52 is attached to the outer cylindrical wall of the filter 50 for preventing leakage of minute dirt or dust particles through the air holes 51, but this fine filter layer is not limited to non-woven fabric only. Thus, any other forms of textile, or a sponge material may be used. The air holes 51 are either circular or elliptical.

The rotation supporting section 70 includes a plurality of steel balls 71 press-fitted in an annular arrangement in a flange portion 50a which extends outwardly from the open end of the filter in a perpendicular direction. A supporting plate 72 connected to the outer casing 40 and having a filter positioning hole 72a formed in its middle portion has a first annular guiding groove 72b for movably supporting the steel balls 72. A guiding ring 73 is fixed on the supporting plate 72 to overlap and trap flange portion 50a and has a second guiding groove 73b aligned to correspond to the first guiding groove 72b for movably supporting the steel balls 71. Here, the number of steel balls 71 ranges from 6 to 12. The outer circumference of the supporting plate 72 is connected to the outer casing 40 by anastomosis, and the guiding ring 73 is fixed on the supporting plate 72 by a plurality of screws 74. For smooth rotation of the filter 50, there is a gap between the periphery of the filter positioning hole 72a of the supporting plate 72 and the filter 50. Also, the guiding ring 73 and the supporting plate 72 have to be in contact with each other at a certain clearance from each other. To prevent a reverse current of dirt and dust through the gap, an annular sealing member 53 is disposed around the

outer circumference of the filter 50 to form a seal between the filter wall and the supporting plate 72.

The filter 50 has a plurality of vanes or wings 55 which project at equal intervals from the filter outer wall into the space between the filter outer wall and the wall of the dirt collecting container 60. There they are in the path of the circulating air current caused by the air current sucked in through the guiding port 43 formed on the outer casing 40. Although four vanes 55 are shown in the drawing, any proper number of vanes 55 may be used. Also, although the vanes 55 are not shown in detail in the drawing, they may be simply fitted into fixing slots formed on the filter 50, and are preferably curved in a direction taking account of the air current direction.

In an alternative embodiment and as shown in Figure 5, the vanes 55 may be disposed on the inner circumference of the filter 50 at the same position and by the same method described above. In this case also, the vanes 55 help the filter 50 to be rotated efficiently by the air current. Since the vanes 55 are here disposed along the inner circumference of the filter 50, the shape of the air holes 51 formed in the filter 50 is changed. Accordingly, the air holes 51 are shaped as slots having certain widths and extending lengthwise parallel to the axis of rotation. Again, the vanes 55 may be curved in a proper direction according to the direction of the air current for efficient rotation of the filter 50.

The dirt collecting container 60 is substantially hemispherical and is detachably mounted on the outer casing 40. The container 60 confines the air currents due to air sucked into the container through the port 43 causing them to circulate around the filter 50. The container 60 collects dirt and dust which are separated from the air and drop due to the centrifugal force generated from the circular air current. It is preferable that the dirt collecting container 60 is made of a transparent/translucent material to enable a user to check the level of collected dirt and dust in the dirt collecting container 60. A handle 80 is integrally formed at the middle portion of the upper end of the dirt collecting container 60 for easy handling of the dirt collecting section 30.

In the vacuum cleaner described above, tight coupling of the depression formed in the partition 11 of the body 10 with the cone-shaped portion formed in the outer casing 40 of the dirt collecting section 30, allows the dirt collecting section 30 to be smoothly mounted and easily located on the body 10 of the vacuum cleaner. The suction brush connecting port 13 of the body 10 is then connected with the suction brush hose 12.

When the motor 20 is operated, dirt and dust on the cleaned surface are sucked in through the suction brush along with air. The air containing dirt and dust then flows into the dirt collecting section 30 through the suction brush connecting port 13, the air inlet 41 formed in the outer casing 40, and the guiding port 43. Here, air flows obliquely into the dirt collecting container 60 due to the orientation of the guiding port 43, resulting in a circular air current in the dirt collecting container 60 which centrifugally separates various kinds of dirt and dust from the air. Simultaneously, the movement of air flowing in through the guiding port 43 causes the filter 50 to rotate, and accordingly, dirt and dust are prevented from clinging to the outer circumference of the filter 50, specifically to the filtering wall, and the filtering effect of the filter 50 is maximized.

Once separated from the air, dirt and dust fall into the dirt collecting container 60, and the cleaned air is discharged out through the discharging hole of the body 10 via the air outlet 42 formed in the outer casing 40 of the dirt collecting section 30, and the interconnecting hole 14 formed in the partition 11 of the body 10.

When the amount of dirt and dust reaches a certain level in the dirt collecting container 60, as observed by the user through the transparent/translucent portion of the dirt collecting container 60, the user can empty the dirt collecting container 60 by simply pushing the upper portion of the dirt collecting container 60 to separate the dirt collecting section 30 easily from the body 10.

In the above described cleaner the filter is rotated by a simple structure, and the whole structure of the cleaner is also simplified. Accordingly, handling and use of the cleaner is easier and, due to a reduced number of components and the simpler structure, the manufacturing process is simplified and inexpensive.

CLAIMS

1. A vacuum cleaner comprising:

a body having open and closed spaces separated by a partition, a suction brush connecting port which is formed on an upper side of the body and is interconnected with the open space, and an interconnecting hole formed on the partition for interconnecting the open and closed spaces;

a motor mounted in the closed space of the body for generating a suction force; and

dirt collecting means detachably mounted in the open space of the body for centrifugally separating dirt and dust contained in the air sucked in through the suction brush connecting port by the motor when in operation;

the dirt collecting means having:

an outer casing having an air inlet and outlet which respectively correspond to the suction brush connecting port and the interconnecting hole;

a cylindrical filter rotatably mounted on the outer casing by a rotational supporting member and having one end closed and a plurality of air holes which are formed along the outer circumference;

at least four rotating wings formed on the filter for rotating the filter in response to air current entering through the air inlet; and

a dirt collecting container detachably formed on the outer casing to enclose the filter.

2. The vacuum cleaner according to claim 1, wherein the rotational supporting member comprises:

a plurality of steel balls press-fitted to a flange portion which extends outwardly from the open end of the filter;

a supporting plate connected to the outer casing and having a filter positioning hole formed in its middle portion, and a first guiding groove formed adjacent to the filter positioning hole for movably supporting the steel balls; and

a guiding ring fixed on the supporting plate and having a second guiding groove

corresponding to the first guiding groove for movably supporting the steel balls.

3. A vacuum cleaner according to claim 2, wherein the number of steel balls is at least six.

4. A vacuum cleaner according to claim 2 or claim 3, further comprising a sealing member mounted on the filter for preventing leakage of dirt and dust through a gap between the filter positioning hole of the supporting plate and the filter.

5. A vacuum cleaner according to any preceding claim, further comprising a fabric layer attached to the outer circumference of the filter for preventing leakage of dirt and dust through the air holes.

6. A vacuum cleaner according to any preceding claim 1, wherein a plurality of longitudinally orientated filter rotating wings are formed on the outer circumference of the filter at equal intervals.

7. A vacuum cleaner according to claim 6, wherein the air holes are circular or elliptical.

8. A vacuum cleaner according to any preceding claim, wherein a plurality of longitudinally orientated filter rotating wings are formed on the inner circumference of the filter at equal intervals in a longitudinal direction.

9. A vacuum cleaner according to claim 8, wherein the air holes of the filter are slots which extend in a longitudinal direction of the filter.

10. A vacuum cleaner according to any preceding claim, further comprising a handle formed on one side of the outer circumference of the dirt collecting container for handling the dirt collecting container.

11. A vacuum cleaner in which dirt is separated from air drawn into the cleaner by centrifugal action, wherein the cleaner comprises a cleaner body defining a closed suction space, a motor unit for withdrawing air from the closed suction space, a dirt collecting container detachably mounted to the cleaner body and having a interfacing wall which abuts the cleaner body and has an air outlet in registry with an interconnecting hole in the cleaner body, and a suction hose connection port communicating with the interior of the dirt collecting container, and wherein the dirt collecting container encloses a hollow filter which is rotatably mounted to the interfacing wall by means of an annular bearing surrounding the air outlet and which has vanes located so as to impart a rotating force on the filter in response to a circulating air current within the dirt collecting container.

12. A vacuum cleaner according to claim 11, wherein the filter has a substantially cylindrical outer filtering wall and the vanes are formed on the outside of the filtering wall to extend in a longitudinal direction defined by the axis of rotation of the filter.

13. A vacuum cleaner according to claim 11, wherein the filter has a substantially cylindrical outer filtering wall and the vanes are formed on the inside of the filtering wall to extend in a longitudinal direction defined by the axis of rotation of the filter.

14. A vacuum cleaner according to any of claims 11 to 13, wherein the annular bearing is formed by the combination of an annular flange housing ball bearings and an annular channel which receives the flange and the ball bearings.

15. A vacuum cleaner constructed and arranged substantially as herein described and shown in the drawings.